



Research article

New genera and problematic species in African Lithosiinae (Lepidoptera, Arctiidae, Lymantriidae)

Antonio DURANTE

Museo di Storia Naturale del Salento, via Europa, 95. 73021 Calimera, Italy.

E-mail: antonio.durante@msns.it

Abstract. This paper deals with some problematic species in the subfamily Lithosiinae. Two new monospecific genera are proposed: *Parafrasura* gen. nov. and *Palaeugoa* gen. nov. The former presents the following autapomorphies: tegumen strong and large; uncus long and slightly claviform; typical scaphium-gnathos complex. The latter presents as autapomorphies the disposition of the bands of the wings pattern, and the male genitalia shape. *Asura naumanni* Kühne, 2005 is considered *incertae sedis* within Lithosiinae and *Asura phaeosticta* Kiriakoff, 1958 is transferred to *Euproctis* Hübner, [1819] (Lymantriidae) (comb. nov.).

Key words. Lithosiinae, Lymantriidae, new genera, problematic species, Afrotropical Region.

Durante A. 2012. New genera and problematic species in African Lithosiinae (Lepidoptera, Arctiidae, Lymantriidae). *European Journal of Taxonomy* 22: 1-16. <http://dx.doi.org/10.5852/ejt.2012.22>

Introduction

Some studies on Lithosiinae in the African fauna led to the review of the genus *Tumicla* Wallengren, 1860 (Durante 2008) and to the description of the genus *Afrasura* Durante, 2009 (Durante 2009).

The examined material was constituted by species formerly included mainly in the genus *Asura* Walker, 1854 (Hampson 1900, 1914; Strand 1922; Seitz 1943; Vári *et al.* 2002; Kemal & Koçak 2007), which is at the present limited to the Oriental and Australian regions (Common 1990; Edwards 1996; Holloway 2001; Durante 2009). In the course of the survey, several specimens could not be assigned to the genera *Tumicla*, *Afrasura* and *Asura*, being clearly different in genitalic morphology, though similar in external appearance.

The present contribution aims at providing a solid base of systematic knowledge on African Lithosiinae, even if some new taxonomic acts have not been supported by a large number of examined specimens, due to the objective scarceness of African material in the collections.

Some recent revisionary studies of the Noctuoidea (Fibiger & Lafontaine 2005; Lafontaine & Fibiger 2006; Mitchell *et al.* 2006; Zahiri *et al.* 2010) proposed several nomenclatural changes at suprageneric level, although a consensus view will probably still take some time to emerge. Until such time, this paper follows a conservative nomenclature leaving the rank of family to the Arctiidae; see also Conner (2009) for more extensive remarks.

Material and methods

Techniques for dissecting, staining, mounting, and photographing are described in Durante (2008). Morphological terms follow Birket-Smith (1965), Klots (1970), Tikhomirov (1979), Kristensen (2003).

Abbreviations

BM ARCT = Arctiidae collection of the BMNH; BMNH: The Natural History Museum (formerly British Museum (Natural History)), London.

g.sl. = genitalia slide.

NHRS = Naturhistoriska Riksmuseet, Stockholm.

All the examined material is part of the BMNH collection, except for the type of *Tumicla sagenaria* (Wallengren, 1860) housed in the NHRS. The *Asura naumanni* type is in Lars Kühne's private collection (Kühne 2005).

Results

Phylum Arthropoda Latreille, 1829
Class Insecta Linnaeus, 1758
Order Lepidoptera Linnaeus, 1758
Family Arctiidae Leach, 1815
Subfamily Lithosiinae Billberg, 1820

Four cases of interesting and problematic species are hereafter reported. The fourth of them deals with a Lithosiinae species here transferred to the family Lymantriidae.

Parafrasura gen. nov.

Type species

Asura pectinella Strand, 1922, by present designation.

Diagnosis

Monospecific genus externally very similar to *Afrasura* and *Tumicla*. Differential characters: two basal bands on the forewings upperside (a single basal band in *Tumicla*); bipectinate antennae of the male (filiform or serrate in *Afrasura* and *Tumicla*); spur formula 0-4-4 (0-2-2 in *Tumicla*); coremata absent; uncus long and slender, clubbed (shorter, often curved, ending in a point in *Afrasura* and *Tumicla*); tegumen strong; scaphium well sclerotized; distal end of the valva undivided, with a finger-like process (valve clearly divided valva in *Afrasura*; a different kind of distal process present in *Tumicla*); presence of the processus distalis plicae (absent in *Afrasura*); vinculum without saccus; vesica with a cluster of very small and sparse thorns; no strong cornuti.

Etymology

The prefix “para”, from ancient Greek, means “similar to” and indicates the probable relationship with the genus *Afrasura*. The gender of the new name is feminine.

Description

The descriptions of Bethune-Baker (1911) and Hampson (1914) of *Asura pectinata* are comprehensive enough with regard to external appearance of its body and wings (Fig. 1A-E).

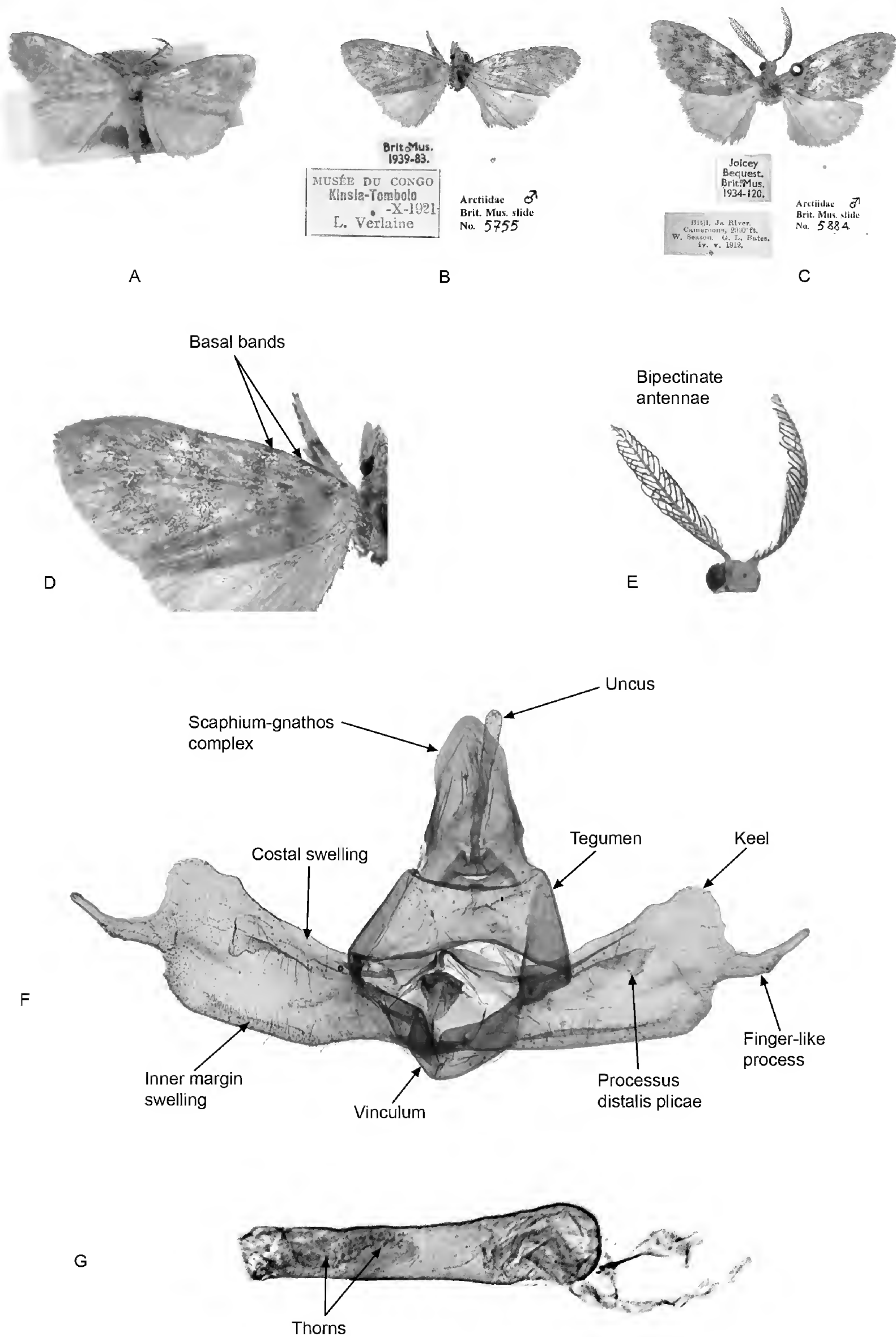


Fig. 1. *Parafrasura pectinella* (Strand, 1922). **A.** Holotype ♂, Angola, in BMNH. **B.** ♂, Democratic Republic of the Congo, in BMNH. **C.** ♂, Cameroun, in BMNH. **D.** Enlarged Fig. B, showing the basal bands of the forewing. **E.** ♂, head of Fig. C enlarged, showing the bipectinate antennae. **F.** ♂ genitalia, g.sl. BM ARCT 5741, Chad. **G.** Aedeagus, g.sl. BM ARCT 5741, Chad.

MALE ABDOMEN. With VII and VIII urites smaller than the previous ones. VIII sternum with anterior margin slightly waved; VIII tergum anterior margin with a bar-like reinforcement with two small apodemes at its lateral extremities.

GENITALIA. (Fig. 1F-G) With uncus long and slender, claviform. Tegumen large and short, stronger than usually found in *Asura*-like genera (i.e. *Asura*, *Afrasura*, *Tumicla*). Posteriorly to the tegumen, two strong arms arise and suddenly meet together, forming a strong sclerotized structure (gnathos), which includes the sclerotized dorsal surface of the tuba analis (scaphium). Vinculum. Slender, semicircular, without saccus, tightly linked to the valvae. Anellus dorsally with a slightly sclerotized W-shaped transtilla, and ventrally with a quite large dome-shaped membranous juxta, not visible in the slide preparation.

VALVA. Slightly widening from the base to the distal margin, linked to the vinculum except for the costa. Two longitudinal swellings extending parallel from base to the distal 4/5: the first one just under the costal margin, the second one along the inferior margin (ala valvae of Birket-Smith 1965). At the apex, the valva possesses a keel-like enlargement; at the middle of the distal margin a finger-like process.

AEDEAGUS. Small, tubular, with a bulbous coecum. Vesica with sparse tiny thorns.

FEMALE GENITALIA. These have not been directly examined, but the described characteristics (Kühne, 2007: 365) seem to be exclusive, particularly the sclerotizations of the ostium bursae and the bag-shaped invagination proximad of the ostium.

Remarks

Asura pectinella Strand, 1922 was firstly described by Bethune-Baker (1911) in the genus *Asura* as *A. pectinata* (*nom. praeocc.*); the genitalia morphology, however, leads to the conclusion, that it should be included in a genus of its own. Already Kühne (2007) rightly separated this species in a group of itself, however leaving it in the genus *Asura*.

A new genus is here described after the examination of specimens from Western and Central Africa, whose size and wing pattern are very similar to *Afrasura* (Fig. 2A) and *Tumicla* (Fig. 2B). However the

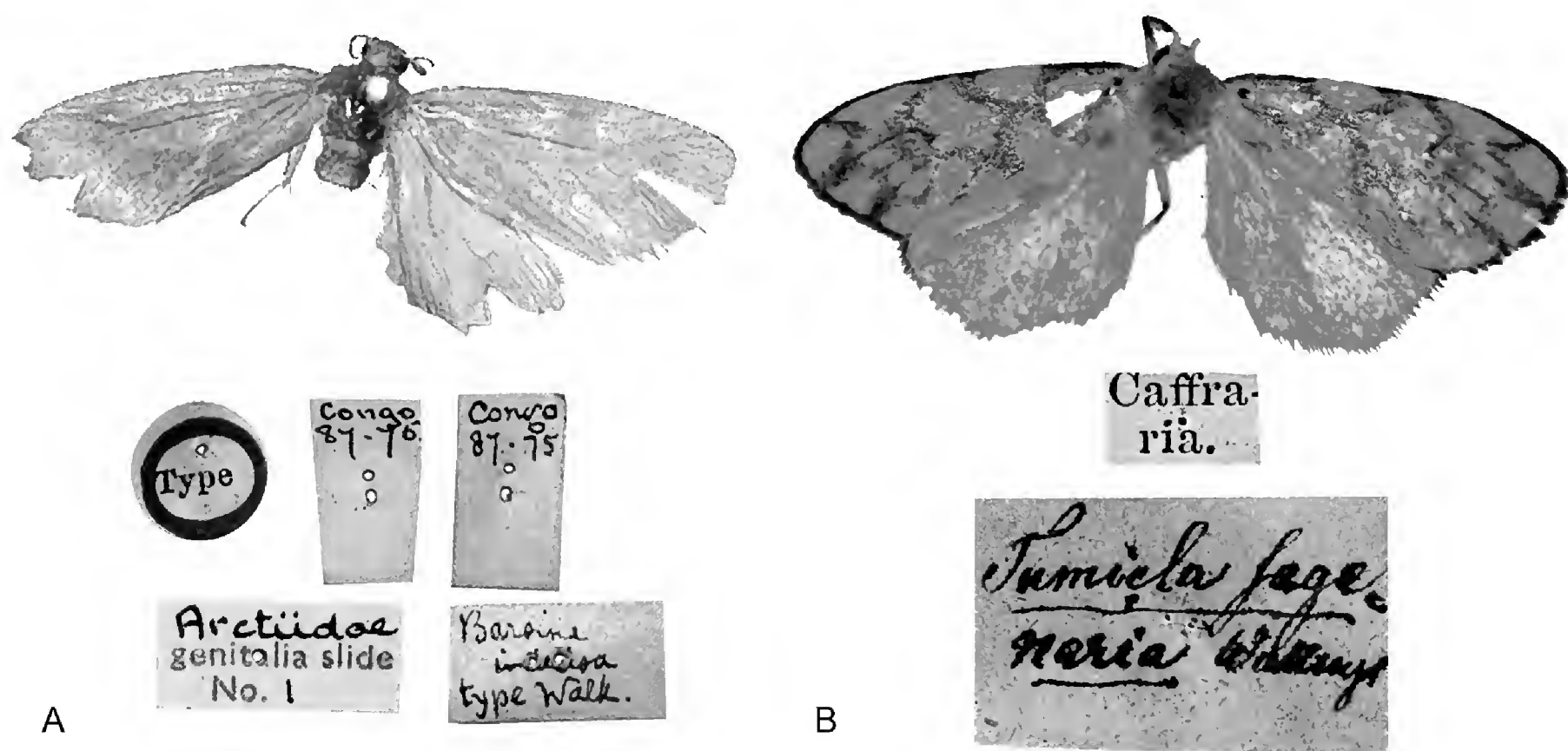


Fig. 2. — **A.** *Afrasura indecisa*, holotype ♂, Congo, in BMNH. — **B.** *Tumicla sagenaria*, holotype ♂, South Africa, in NHRS.

male bipectinate antennae and genitalic peculiarities are here considered strongly distinctive and have never before been observed in the aforementioned, probably related genera.

The new genus shows a wing venation and pattern very similar to that of *Afrasura*, so that the venation and the two basal bands are considered synapomorphic characters of the *Afrasura-Parafrasura* group.

Probable autapomorphies of *Parafrasura* are: tegumen strong and large; uncus long, slender, slightly claviform; shape of the scaphium-gnathos complex.

Other relevant characters are: male antennae bipectinate; female with short anterior apophyses and sinus vaginalis conformation.

Parafrasura pectinella (Strand, 1922) comb. nov.
(Fig. 1A-E)

Asura pectinella Strand, 1922: 793.

Asura pectinata Bethune-Baker, 1911: 537.

Diagnosis

Species characterized by the strong scaphium firmly connected with the gnathos arms; valva with digitiform process at the middle of the outer margin; aedeagus small, tubular, with a bulbous coecum; vesica with sparse tiny thorns.

Type locality

Angola, N'Dalla Tando (holotype ♂ examined, genitalia not dissected, in BMNH).

Material examined

CHAD: ♂ Arct. g.sl. n. 5741 BMNH. CAMEROUN: ♂ Arct. g.sl. n. 5884 BMNH. DEMOCRATIC REPUBLIC OF THE CONGO: ♂ Arct. g.sl. n. 5755 BMNH.

Distribution

Asura pectinella was originally described by Bethune-Baker (1911) from Angola; Hampson (1914) and Strand (1922) report the species from Cameroun; to these countries, the Chad and the Democratic Republic of the Congo (BMNH collection) are added here.

Description

See under the generic account.

Palaeugoa gen. nov.

Type species

Xanthesis spurrelli Hampson, 1914, by present designation.

Diagnosis

Forewings larger than in *Xanthesis*, as observed after comparison with the type species *X. luzonica* (Felder, 1875), with rounded apex. Wing pattern superficially similar to *Afrasura*, but more punctuate and with different distribution of bands (see differential diagnosis below). Male genitalia resembling *Eugoa* Walker, 1857 (type species *Eugoa aequalis* Walker, 1857 from Borneo) with dorsal processes of the tegumen and short and stout uncus, but differing in valvae structure.

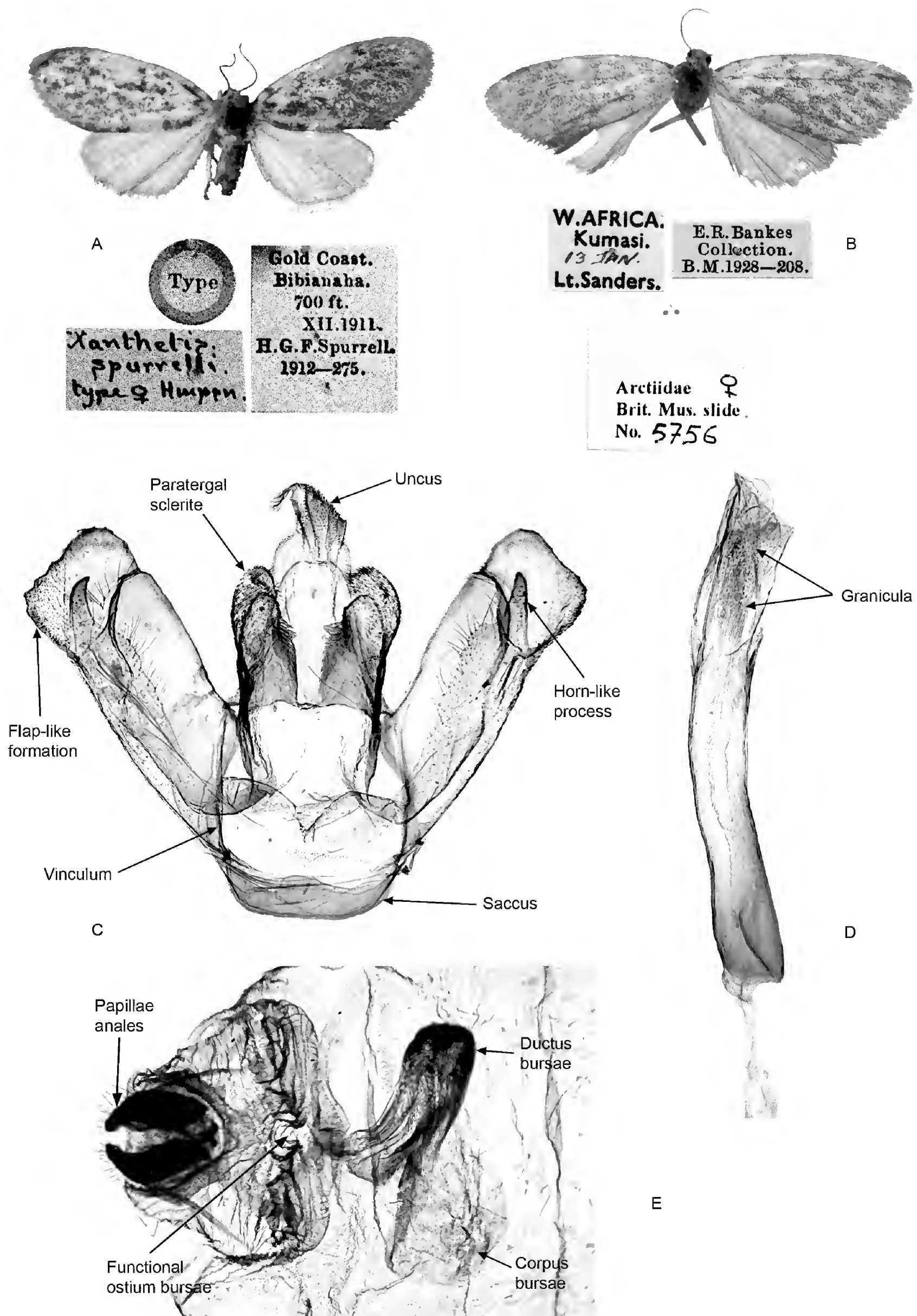


Fig. 3. *Palaeugoa spurrelli* (Hampson, 1914). **A.** Syntype ♀, Ghana, in BMNH. **B.** ♀, Ghana, in BMNH. **C.** ♂ genitalia, g.sl. BM ARCT 301, Ghana. **D.** Aedeagus, g.sl. BM ARCT 301, Ghana. **E.** ♀ genitalia, g.sl. BM ARCT 5756, Ghana.

Etymology

The name *Palaeugoa* has no phylogenetic implications, it simply refers to its Western Palaeotropical distribution. The gender is feminine.

Description

The description of Hampson (1914) about the external features is very accurate (Fig. 3A-B).

MALE GENITALIA. (Fig. 3C-D) With a more robust general structure than in *Asura* and *Afrasura*. Uncus short but large; tegumen with conspicuous paratergal sclerites; vinculum slender with a large and shallow saccus; valvae rectangular with straight costa turning inwards at three-quarters. Ala valvae (sacculus) membranous as long as the costal margin, ending in a strong horn-like process. The proximal three-quarters of valva surmounted by a distal flap-like formation with a slightly waved margin.

AEDEAGUS. Tubular, slender, slightly curved; vesica with a sparse group of granicula (see Tuxen 1970, for grammatical gender).

FEMALE PHEROMONE GLAND. With a large base and two anterior quite deep lobes.

FEMALE GENITALIA. (Fig. 3E) With sinus vaginalis anteriorly delimited by posterior margin of the seventh sternite, forming a slightly sclerotized plica. Posteriorly it is delimited by the scarcely sclerotized eighth sternite, whose anterior margin forms a short backward plica. This is interrupted medially by a funnel-shaped excavation that probably serves as a functional ostium bursae and antrum, whereas the true ostium bursae lies deeper at its anterior end, membranous, concealed by the VII sternum plica.

DUCTUS BURSAE. After a very short, narrow and membranous portion, enlarging in a sac-like structure (cervix?) more sclerotized and transversally displaced with scattered spines inside.

CORPUS BURSAE. Spherical, membranous, without signa; ductus seminalis arising caudally from it. Anterior apophyses short, posterior apophyses long and slender. Papillae anales ventrally concealing two small pseudopapillae (*sensu* Maes 1984).

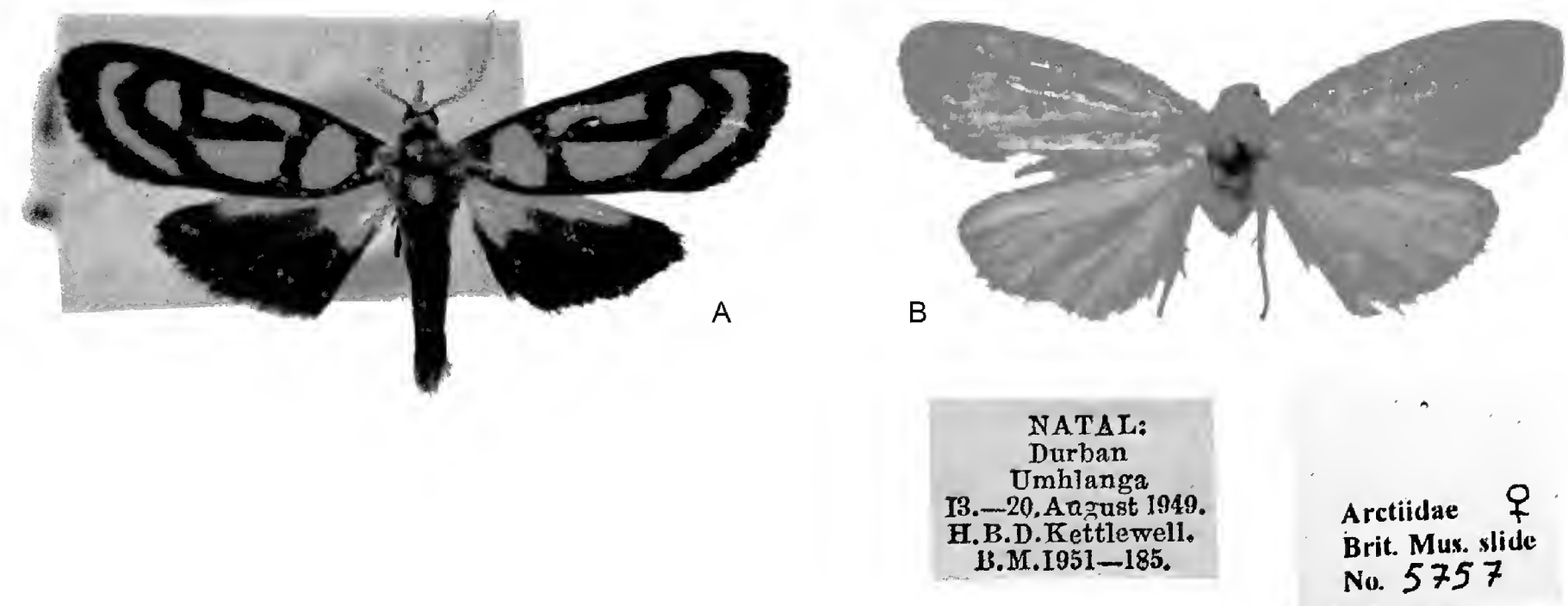


Fig. 4. — A. *Xanthetis luzonica* (Felder, 1875), holotype ♂, Philippines, in BMNH. — B. *Afrasura ichorina* (Butler, 1877), ♀, South Africa, in BMNH.

Remarks

Xanthetis spurrelli from the Gold Coast is a problematic species; it was not placed in the genus *Afrasura* Durante, 2009, despite of its similar appearance.

The genus *Xanthetis* Hampson, 1900 was described based on the type species *X. luzonica* (Fig. 4A) from the Philippines and on *X. ichorina* (Butler, 1877) (Fig. 4B) from Natal, which share a similar wing venation, but differ in wing shape and pattern, and in the genitalic morphology. On the basis of these differences *ichorina* was transferred to *Afrasura* by Durante (2009), whereas *luzonica* is retained in *Xanthetis*, a genus here considered at least apparently similar to the Australian *Asura* (the question whether the similarity is due to shared common ancestry is not discussed herein).

The description of *spurrelli* in Hampson (1914) starts with the statement of the coincidence of veins 3 and 4 in the hindwings, whereas they are stalked in *luzonica*. It should be remarked once more (Durate 2004) that this character is inconstant at least among the Lithosiinae, in fact veins 3 and 4 are coincident only in the right hindwing of the examined female of *spurrelli* from Kumasi, whereas they are stalked in the left hindwing (see also the case of *Afrasura ichorina* in Durante 2009).

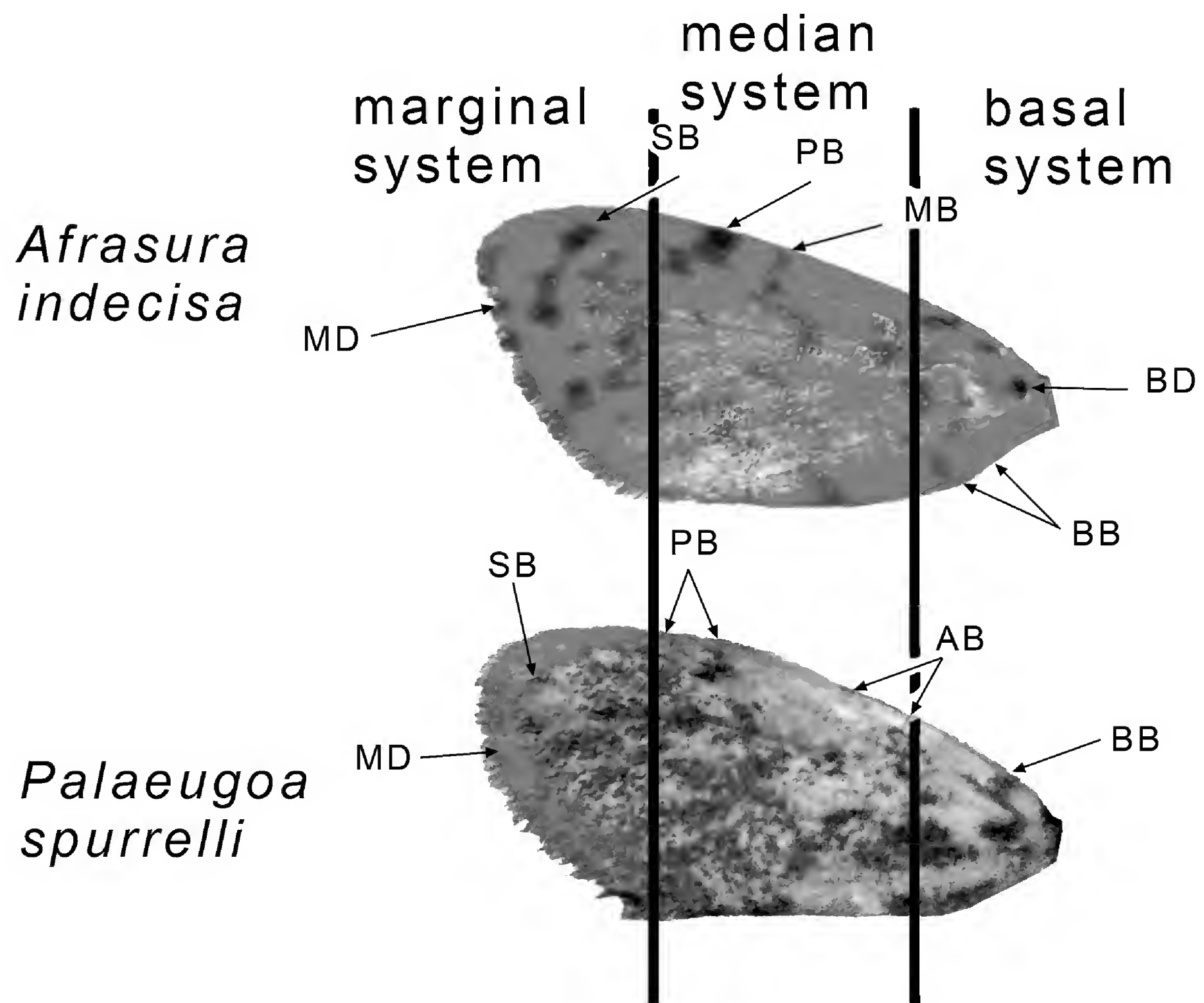


Fig. 5. Forewing of *Afrasura indecisa* (top) and *Palaeugoa spurrelli* (bottom) and their related pattern symmetry systems. AB, antemedian bands; BB, basal band(s); BD, basal dot; MB, median band; MD, marginal dots; PB, postmedian band(s); SB, submarginal band.

The new genus is here proposed due to the instability of the venational characters used by Hampson (loc. cit.) to delineate the taxa, differences in wing pattern and markedly different genitalic morphology.

It could be significant to compare the wings pattern of *Palaeugoa* gen. nov. to the one of *Afrasura*.

In their general appearance, the two genera present a quite similar pattern, suggesting a similar response to the selective pressure; however, the substantial differences in the position of the different elements of the pattern and differences in genitalic morphology indicate that they are in fact not closely related.

In fact, *Afrasura* presents a sequence of band systems that is well defined and shared by all of its species, with the presence of two basal bands considered an apomorphic character (Durante 2009). The bands correspond as follows:

<i>Afrasura</i>	<i>Palaeugoa</i>	Symmetry systems
two basal	one basal	basal system
one median	two antemedian	median system
one postmedian	two postmedian	median system
one submarginal	one submarginal	marginal system

The different number of bands in the basal and median systems is noteworthy (Fig. 5), and the relative position of the corresponding bands in different areas of the wings is emphasized (i.e. the basal band in *Palaeugoa* is slightly more basally positioned than the more proximal of the two basal bands in *Afrasura*, and the two antemedian (AB) bands of the former are more proximally located than the single band (MB) of *Afrasura*). A potential inference of this is that the respective positions of wing bands within the symmetry systems of *Afrasura* and *Paleugoa* are not homologous.

The second important character complex that should be examined is the genitalic apparatus.

The differences between *Asura* and *Afrasura* are both in the general appearance and in the details: the uncus shape of *Palaeugoa* is never seen in *Asura* and *Afrasura*, the tegumen of the former bears two very strong processes (paratergal sclerites), the saccus is very large and shallow, valva with well separated dorsal (supravalva) and ventral (ala valvae) regions ending together in a flap-like structure (perhaps corresponding to the cucullus of Kôda 1987), whereas, in the latter two genera, the paratergal sclerites are only weakly developed, the saccus is deeper and more narrow, valva with the two regions hard to delimit, apart from their two terminal processes. A similar condition is seen in *Tumicla*, with the exception of the valva, which is even more simple (see Durante 2008).

A more similar genitalia structure is found in the Oriental genus *Eugoa* (type species *Eugoa aequalis* (Walker, 1857), Fig. 6A). This genus has recently been revised by Holloway (2001) for the Bornean fauna, but some uncertainties still remain; in the present work *Eugoa* is considered in a very strict sense taking into account only the type species and the very similar *Eugoa trilacunata* Holloway, 2001, even if some other species could be included (e.g. *Eugoa bipunctata* (Walker, 1862)). Essentially, similarities in the male genitalia of the two genera (*Palaeugoa* and *Eugoa*) are limited to the short uncus and the well-developed processes of the tegumen, otherwise they are quite different. In *Eugoa* the uncus itself is of a different shape and surmounted by strong setae (absent in *Palaeugoa*); the saccus is practically absent; the valvae represent the most diverging character: they are entire, bearing on the inner margin long costally directed setae, with the sacculus not ending in a distal process (Fig. 6B).

Some additional observations are useful in separating the two genera: the forewing shape is rectangularish in *Eugoa* (quite rounded in *Palaeugoa*); in *Eugoa* the pattern consists of dark fasciae on white-grey ground; forewings venation with Sc anastomosing with R; Rs1 free; the stalked pairs (Rs2+Rs3), (Rs4+M1) and (M2+M3); whereas in *Palaeugoa* the pattern is as seen in the description above, the anastomosis is lacking, vein Rs2 is absent, all veins are free, but Rs3+Rs4 are stalked.

Taking into account these differences, a close relationship between the two genera is at least doubtful, even though they are referable to the same tribe.

Holloway (2001) did not include *Eugoa* in any described tribus (according to Bendib & Minet 1999), similarly *Palaeugoa* is at the moment unassigned.

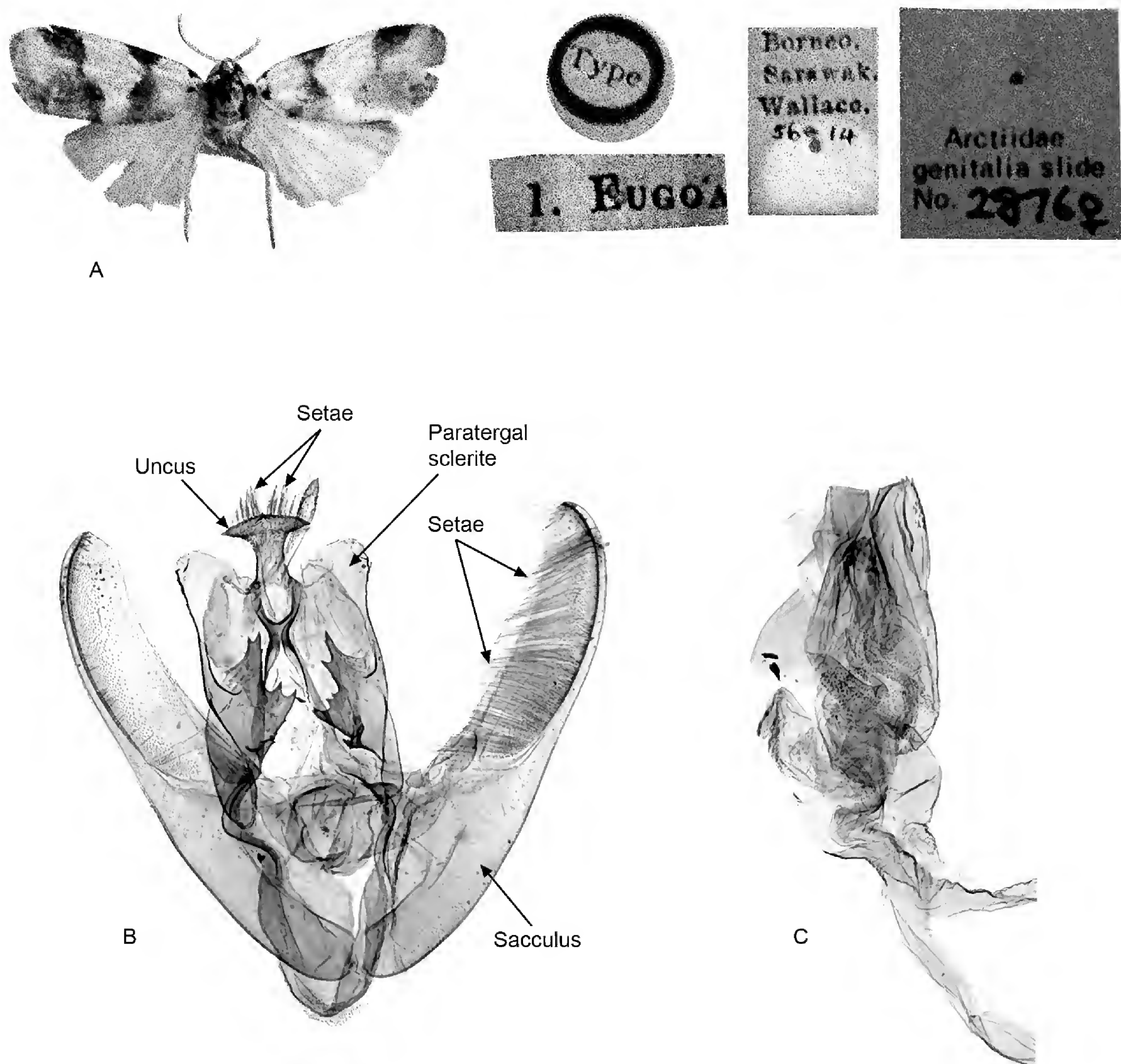


Fig. 6. *Eugoa aequalis* (Walker, 1857). **A.** Holotype ♀, Borneo, in BMNH. **B.** ♂ genitalia, g.sl. BM ARCT 5057, Borneo. **C.** Aedeagus, g.sl. BM ARCT 5057, Borneo.

Palaeugoa spurrelli (Hampson, 1914) comb. nov.
(Fig. 3A-E)

Xanthetis spurrelli Hampson, 1914: 728.

Diagnosis

This species is easily separable from all members of the genus *Afrasura* on account of its highly distinctive genitalic morphology (uncus, valvae and aedeagus shape). In particular, the composite structure of the valva and its flap-like distal end permit ready distinction from *Eugoa aequalis*.

Material examined

3 syntypes (1 ♂ and 2 ♀♀); 1 ♂ Arct. g.sl. n. 301 BMNH; 1 ♀ Arct. g.sl. n. 5756 BMNH (all in BMNH).

Type locality

GOLD COAST [Ghana], Bibianaha (1 ♂, 2 ♀♀ syntypes examined, abdomens not dissected, in BMNH).

Description

See under the generic account.

Distribution

Ghana.

“*Asura*” *naumanni* Kühne, 2005

Asura naumanni Kühne, 2005: 486-493.

Diagnosis and description

See the original description (Kühne 2005).

Material examined

Only known from the original description.

Type locality

RWANDA, Akagera riv., S Kibungo/Ibanda-Makera (holotype ♂ not examined, in the author’s private collection).

Remarks

“*Asura*” *naumanni* is a further problematic species. In fact, after the revision of the afrotropical species formerly included in *Asura*, leading to their inclusion in the genera *Tumicla* and *Afrasura* (Durante 2008, 2009), it is difficult to assign this species to one of these genera or to *Asura* itself.

The external aspect of this species markedly differs from *Afrasura* and *Tumicla* as regards to distribution, shape, origin and development of the wing pattern bands. Male genitalia confirm such differences, mainly the very short uncus and the general shape of the valvae.

Judging from the illustration (Kühne 2005: 493), the processus distalis plicae seems to be present and the vesica seems to have two clusters of strong thorns without a single big cornutus, as opposed to *Afrasura*, for which they are distinctive characters.

At the moment this species should be considered as being *incertae sedis* within the Lithosiinae, pending a comparison with other genera.

Female genitalia are neither described nor figured in the original work.

Distribution

Rwanda, Uganda, Kenya.

Euproctis phaeosticta (Kiriakoff, 1958) comb. nov.
(Fig. 7A-H)

Asura phaeosticta Kiriakoff, 1958: 4.

Diagnosis

Male genitalia (figs. 7D-E) with valvae not visibly divided into supra-valva and ala valvae; the latter presents a small process at half of its inner margin (also described by Kiriakoff 1958, but not illustrated in the accompanying picture); the uncus is clearly more robust and large at the base than it is in *Asura* and *Afrasura*; vesica without cornuti.

Female abdomen with A7 prominent and weakly sclerotized; A8 generally membranous, but eighth sternum sclerotized with a median incision of the caudal margin, whereas the anterior margin extends to wrap the sinus vaginalis (in *Asura* and in *Afrasura* the eighth segment is small and membranous).

Ductus bursae stiff and short (Fig. 7F), serving as point of origin of the ductus seminalis (in *Asura* and *Afrasura* the ductus seminalis arises from the cervix bursae). Anterior apophyses extremely reduced; posterior apophyses missing. The structure of abdominal segments 9-10 complex is plurilobate, with two big ventral papillae, an unpaired dorsal papillary structure, two median caudal clubbed lobes, at which base, in latero-ventral position, two other small papillary processes arise (Fig. 7G).

Finally, it should be noted that the apodemes of the sternite of A2 are short and stout (Fig. 7H), instead of long and slender as normally in the tribus Nudariini (Bendib & Minet, 1999).

Material examined

UGANDA, Ruwenzori: ♂ Arct. g.sl. n. 5740 BMNH. TANZANIA: ♀ Arct. g.sl. n. 5751 BMNH, (both in BMNH).

Type locality

Uganda (holotype ♂ examined, lacking the end of the abdomen, in BMNH).

Distribution

Uganda, Ruwenzori. Tanzania (BMNH).

Remarks

Examination of the male genitalia of this species shows that it does not belong to *Asura* or *Afrasura*, but is a representative of the Lymantriidae, which is also confirmed by the presence in males of 3-1 divergent setae at the apex of the ramus of each flagellomere (Kitching & Rawlins 1999: 386); by the plurilobate structure of abdominal segments 9-10 complex (papillae anales and pseudopapillae; see Maes 1984); and by the absence of female pheromone dorsal glands between A8 and A9 (see Holloway 1988; Bendib & Minet 1998).

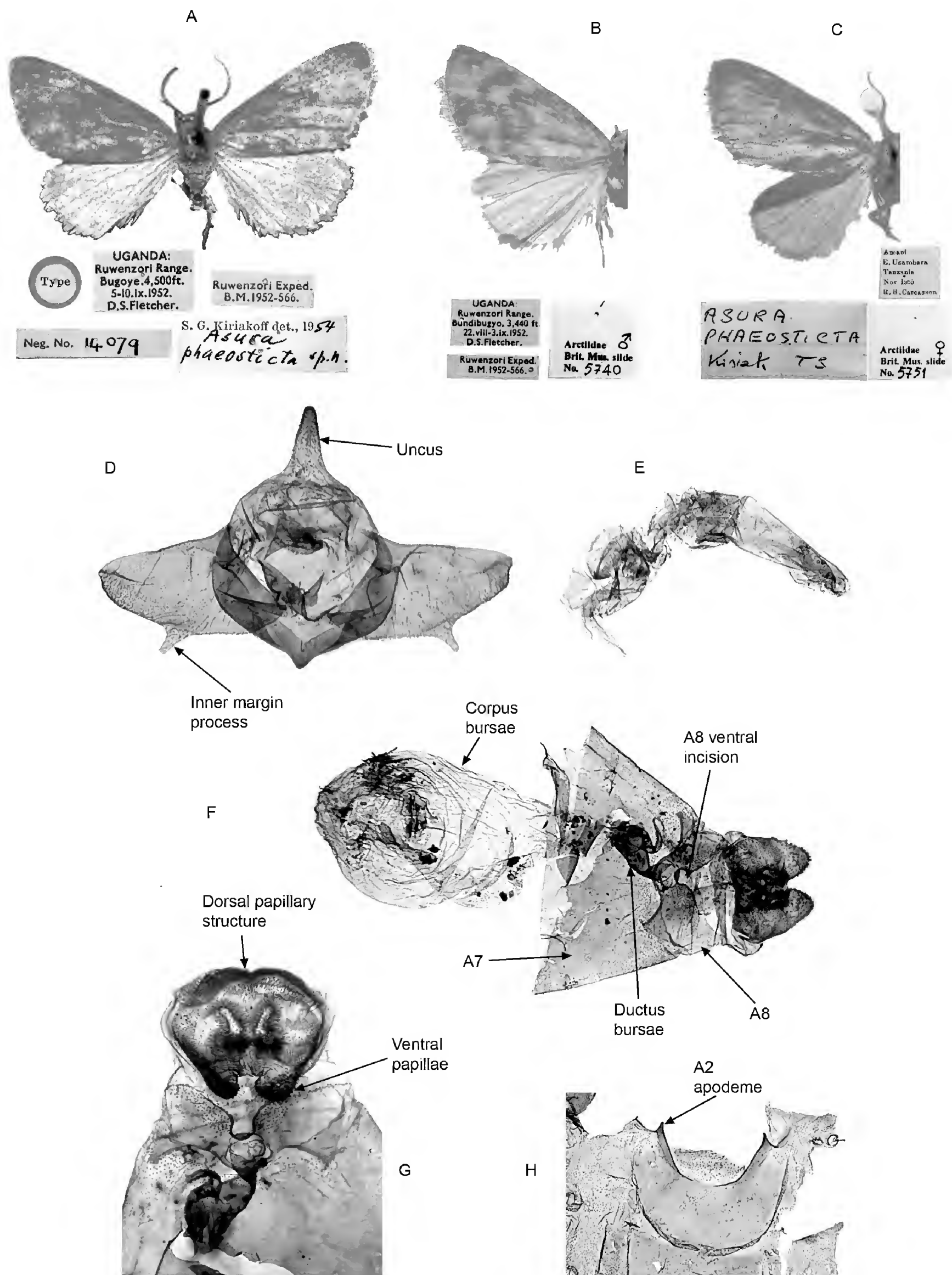


Fig. 7. *Euproctis phaeosticta* (Kiriakoff, 1958) comb. nov. **A.** Holotype ♂, Uganda, in BMNH. **B.** ♂, Uganda, in BMNH. **C.** ♀, Tanzania, in BMNH. **D.** ♂ genitalia, g.sl. BM ARCT 5740, Uganda. **E.** Aedeagus, g.sl. BM ARCT 5740, Uganda. **F.** ♀ genitalia, g.sl. BM ARCT 5751, Tanzania. **G.** ♀, ventro-caudal view of papillae anales, g.sl. BM ARCT 5751, Tanzania. **H.** ♂, sternum A2 apodemes, g.sl. BM ARCT 5740, Uganda.

The generic position of this species is not very clear. According to the wing venation, similar to *Afrasura*, and without considering the anastomosis between veins 11 and 12 in *phaeosticta*, it could be assigned to such genera as *Leucoma* Hübner, 1822 or *Naroma* Walker, 1856, however the genitalia are clearly different. The Malagasy genus *Leptepilepta* Collenette, 1929 (Griveaud 1977) has been considered too, whose genitalia are quite similar, mostly with regard to the shape of the valva which possesses a similar process at the inner margin. It has been, however, excluded on account of the general colour and shape of the wings, the presence of an areola in the forewing venation, the geographic distribution (only Madagascar), the female genitalia being unknown, in addition to some differences of the male genitalia.

Lastly, but not without some reservations, the genus *Euproctis* Hübner, [1819] has been selected since it includes species with similar general appearance, a large geographical range, and similarity of some male genitalia (e.g. *E. lemuria* (Hering, 1926) or *E. imerina* Griveaud, 1977) (particularly the general similarity of the uncus, the valvae and the aedeagus).

Discussion

The revisionary work on African Lithosiinae, and on the whole Arctiidae as well, is just in its early stage (see Weller *et al.* 2009 for a quick outline) and it is normal that papers such as the present will formulate questions rather than find solutions.

Many researchers will agree on the fact that several ways will be explored before reaching a sufficiently complete knowledge of this group. The creation of new genera is believed necessary when a large distance in morphological characters is discerned between different species, even if clear autapomorphies are not established at the same time. The expected better knowledge of new morphological traits together with molecular data, ecological information and life cycle description will single out new apomorphies agreed on by most scientists and founded on a more objective and large basis. It is probable that in Africa, like in other regions (such as in the Oriental Tropics), the Lithosiinae had a quite strong adaptive radiation with many species becoming so specialized that they reach what we consider generic level. This could explain the quite high number of monotypic genera.

At the present, the first goal should be a general knowledge of the main African groups for an initial realistic systematic account.

Many cases like the cited *Asura naumanni* or some others that are not reported for lack of direct knowledge (i.e. *Asura friederikeae* Kühne, 2007 and *Asura pinkurata* Kühne, 2007) are probably better placed in monotypic genera to emphasize their morphological and probably phylogenetic distance from the already known genera.

Acknowledgements

The author thanks Martin Honey, The Natural History Museum, London, UK, for permission to study and dissect the specimens housed there; and Bert Gustafsson, Naturhistoriska riksmuseet, Stockholm, Sweden, for making the holotype of *Asuroides sagenaria* available.

He also thanks Martin Kruger, Transvaal Museum, Pretoria, South Africa, an anonymous reviewer, and Koen Martens, University of Ghent, Belgium for acutely reviewing the draft.

Finally he thanks Daniela Errante and Emanuele Sponsiello, Oxford Institutes, Lecce, Italy, for linguistic suggestions.

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Manuscript received: 12 March 2012

Manuscript accepted: 6 September 2012

Published on: 20 September 2012

Topic editor: Koen Martens

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